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ABSTRACT

A study was conducted to assess the ability of children to distinguish native from non-native English and to determine the age at which they reach the adult level of recognition ability. A brief passage containing the segmental phonemes of English was recorded by ten native and ten non-native speakers of Standard American English. The tape was played to children of varying age groups, who were asked to identify each subject as a native or non-native speaker of American English. The ability to identify non-native speakers was demonstrated to be an increment of age. Five-year-olds showed a 73% rate of accurate identification, and adult criterion (95%) was reached before the age of ten. An explanation for the ranking of misidentified speakers based on contrastive analysis of English and the native language of each speaker was not justified, but non-American native English speakers were more easily identified than native speakers of several foreign languages. The age at which adult criterion is attained coincides with the maximum age at which complete recovery from aphasia is likely, suggesting that competence to recognize non-native speech develops simultaneously with performance limitation which account for the production of non-native speech. (JB)

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"The ontogeny of the ability to recognize foreign accents"*

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They are the stuff of Biblical stories and Bondian capers. They identify us much more readily and dramatically than dress, race, creed, sex, or profession. And they are on everyone's tongues, especially those belonging to linguists and language teachers. As researchers in second language acquisition, we, more than any other group of behavioural scientists, should devote our attention to them, and that is why I would like to discuss with you at this research forum, the phenomenon known as foreign accents.

To set the stage for the data to be reviewed and in order to provide a foundation for the concluding theoretical discussion, I would like to present three prefatory claims taken from a paper delivered at last year's TESOL convention (Scovel, 1976):

1) That foreign accents are phonological cues, either segmental or suprasegmental, which identify the speaker as a non-native user of the language,

2) That the recognition of this phonological non-nativeness is usually immediate and based on a small speech corpus,

and that 3) the ability to recognize a foreign accent is a part of the competence of every native speaker.

Although this present paper focuses on the recognition of foreign accents, it is worthwhile to examine the first claim and look at the production of foreign accents, in particular, the reasons why they are produced. The error analysis (EA) investigations over the past decade into the non-contrastive analysis (CA) etiology of grammatical and lexical errors have proved fruitful and edifying; at the same time, they have been unsuccessful in accounting for the production of phonological errors. Almost by definition, a CA these days concentrates on phonology while an EA deals with morphology and syntax. Despite the advances in second language research in terms of experimental design and statistical techniques, one important question remains unanswered: Why can the syntax of a target language be eventually mastered by some adult learners while phonological errors become persistently and perniciously fossilized? In fact, so dramatic is the difference in terms of fossilization that if we were to build a museum in which to enshrine language learning errors, a comparison between syntactic and phonological mistakes would be similar to contrasting displays of trilobites and stegasauruses!

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Tarone, Swain, and Fathman (1976) have classified explanations for fossilization into three kinds: sociocultural, psychological, and physiological, and, in reviewing the literature which attempts to account for the etiology of foreign accents, it is only the last of these explanations that can adequately deal with the differential fossilization of phonological errors. Let us glance briefly at some of the studies which suggest a sociocultural or psychological reason for the production of foreign accents.

Most of the studies compare children, who, under the appropriate conditions, can become completely bilingual, in contrast with adults, who always emerge with some degree of accented speech. The sociocultural explanations range from abstract environmental differences between the two populations - e.g. the conscious/unconscious dichotomy posed by Wolfe (1967), to more explicit descriptions such as the differences in the way in which the sensory modalities are used in the environment (Geschwind, 1966). Psychological explanations vary too: Krashen (1975), for example, has suggested that the Piagetian milestone of operational thought is a cognitive barrier to the learning of accentless speech. Others (e.g. Taylor, 1974) have suggested affective variables arising at puberty as a psychological cause. But the basic problem with environmental explanations is that they do not account for the fact that the very best adult learners exhibit few, if any, syntactic errors, while no adult learners, even the very best, escape without an accent. In other words, why do sociocultural or psychological variables intervene at the phonological level but not at the level of syntax, which, in terms of linguistic theory, is much more complex and abstract? For this reason, we must abandon explanations founded on nuture and look to those grounded on nature.

Based on Lenneberg (1967), I have suggested that one natural, or physiological explanation for the differentail fossilization of foreign phonology is the loss of brain plasticity associated with the completion of lateralization at early puberty. Dichotic listening experiments conducted by Krashen and Hashman (1972) and Berlin et alia (1973) have indicated that children as young as 5 have a right ear advantage as strong as adults, and, since we know from other studies, Oyama (1976) and Seliger, Krashen, and Ladefoged (1975), that accents to not emerge until around the age of 10, it seems that lateralization is not an adequate measure of the critical period for phonological learning. If, however, we interpret the dichotic listening studies as an indicator of increasing lateralization from birth to puberty, and not as evidence that lateralization is completed, and, furthermore, if we take complete recovery from aphasia as the ultimate measure of brain plasticity and the critical period, we can happily accommodate the dichotic listening evidence into the physiological explanation which I had suggested earlier. Because the production of sounds is the only aspect of linguistic performance which involves neuromuscular activity, sensory and motor activity of extreme precision and subtlety, it is evident why phonological performance is ultimately impaired by loss of plasticity to the motor and sensory cortices of the dominant hemisphere while vocabulary and syntax remain spared from this physiological limitation. Having dealt at some length with these prefatory remarks on the production of foreign accents, let us turn now to the central issue at hand, the experiment on their recognition.

The experiment was designed to assess the ability of children to distinguish native from non-native English and to measure the age at which they reach the adult criterion level of recognition ability. A brief passage containing all of the segmental phonemes of English was read and recorded by 20 speakers: 10 native speakers of Standard American English and 10 non-native speakers. The non-native subjects had all used English for at least ten years and, in order to ensure excellent pronunciation, a panel of 3 experienced EFL teachers was asked to listen to the tape and eliminate any non-native speaker whose pronunciation was less than excellent. On the basis of the panel's recommendation, two non-native informants were replaced. All 20 informants were also asked to write a brief paragraph on the importance of sleep. In both the oral and the written corpora, the native and non-native speakers were presented in random order.

The recorded and written passages were then presented to a group of adult judges, all of whom were native speakers of American English and possessed varying degrees of exposure to foreign pronunciations. The adults were asked to judge the oral and written passages with the following questions: Do the following speakers sound like Americans? and Do you feel the following selections were written by Americans? The results of these two binary tasks are presented in Table I.

TABLE I

Identification of Native/Non-native English by Adult Judges Based on Oral and Written Corpora

	Total Score		Identification of Non-natives Only	
	$\bar{X}$/20	%	$\bar{X}$/10	%
Oral Corpus	18.94	95%	9.74	97%
Written Corpus	11.42*	57%	4.71**	47%

* approaching chance
** less than chance

The judges' responses for each task were divided into two categories - the total score, represented in the first two columns of the table, was simply the mean number correct from the total number of 20 informants, and the identification of non-natives only, the second two columns, which was the mean number correct judged from the 10 non-native speakers only. Although the relationship between the two categories was fairly close for all data elicited in the experiment, it should be pointed out that the second category, the identification of non-natives only, was the most precise measure of the original experimental objective.

The scores for the oral corpus indicate that the adult judges had little difficulty with the task and made almost no errors in correctly distinguishing native from non-native speakers. For the written corpus however, the mean scores plummeted, and the judges were performing at virtually chance level in attempting to distinguish between the two populations.[2] The implications drawn from the discrepancy between the two corpora are twofold: 1) the foreign informants were so good in their use of English syntax and vocabulary that they were indistinguishable from their American counterparts, and 2) at the same time, their phonological performance was easily identifiable from the pronunciation of the American speakers. I would like to call this the "Joseph Conrad phenomenon" in honor of the Polish-born novelist who learned English syntax well enough to become one of the most prominant literary craftsmen that English literature has ever produced and yet, at the same time, was barely comprehensible when he lectured in his adopted second language.[3]

The tape was then played to children of varying age groups who were asked to identify each subject as a native or non-native speaker of American English. For the five year olds, each child was interviewed individually and was asked to point to pictures representing the American and non-American groups. For all the other age groups, the tapes were played in classrooms, and the children were asked to respond on an especially designed scoring sheet. Precautions were taken to eliminate scoring sheets which displayed obvious guessing or extraneous strategies (e.g. all YES's; all YES's and all NO's; no YES's or NO's but crayoned ducks and airplanes!). A standardized scoring procedure was adopted to include those sheets which had less than four invalid answers. Virtually none of the children over seven submitted sheets which were incorrectly marked.

TABLE II

Identification of Native/Non-native English
by Child Judges Based on Oral Corpus

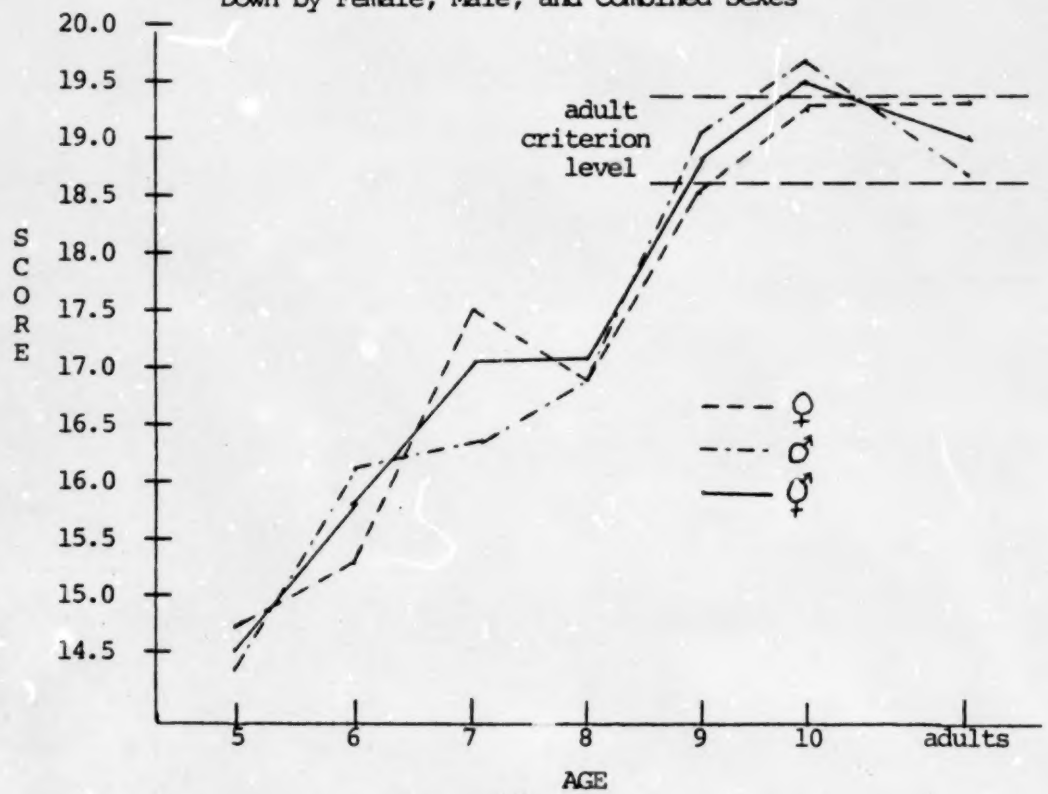
	Total Score		Identification of Non-natives Only	
	$\bar{X}$/20*	%	$\bar{X}$/10**	%
5 year olds (N=8)	14.50	73%	7.75	78%
6 year olds (N=34)	15.71	79%	7.56	76%
7 year olds (N=47)	17.04	85%	8.47	85%
8 year olds (N=9)	17.11	86%	8.11	81%
9 year olds (N=38)	18.76	94%	9.58	96%
10 year olds (N=10)	19.40	97%	9.90	99%

Jonckheere test for ordered alternatives
$H_o = G_1 = G_2 = G_n$ and $H_1 = G_1 < G_2 < G_n$
If $J^* > 2.58$, then null hypothesis can be rejected with $p < .01$
* $J^* = 7.15$
** $J^* = 6.64$

Turning to TABLE II, in which the child data is recorded, it is immediately apparent that the ability to identify non-native speakers is an increment of age. For the total score percentages, there is a consistent linear increase with each age group; for the identification of non-natives only, there are two reversals, the six year olds obtaining a score less than the five year olds (76 per cent to 78 per cent), and the eight year olds obtaining a score less than the seven year olds (81 per cent to 85 per cent). These reversals could be an artifact of the differing sizes of the age groups since the populations of each group differs. This sampling difficulty can be overcome in one of two ways. The consistent linear increase is maintained in the scores for the identification of non-natives only if the age groups are paired (i.e. five with six year olds, seven with eight year olds, and nine with ten year olds), demonstrating that the reversals in the score for the original age groupings do not significantly affect the claim made that discriminatory ability increases with age. The second way in which the sampling problem can be addressed is to use a statistical procedure which compares the raw scores between groups of differing population sizes. Such a test is the Jonckheere test for ordered alternatives, which can evaluate the integrity of $Hypothesis_1$ which claims that the mean score for each group progressively increases irrespective of the population size of the individual groups, contrasting this to the null hypothesis, which claims that there is no significant increment in scores. The Jonckheere test was run on both the total scores and the identification of non-natives only and the null hypothesis was decisively rejected with a $p < .01$.

FIGURE I

Mean Total Scores of Child and Adult Judges Broken Down by Female, Male, and Combined Sexes



The child and adult recognition data is more graphically displayed in FIGURE I which also gives a breakdown of the sexes of the judges. Two observations are worth pointing out in this figure. First, the adult criterion is reached by the nine and ten year olds and is, in fact, surpassed by the older children, but not by a significant level; second, there was no significant sex difference found among the judges (note the alternate crossing of the mean of the combined sex scores by the means of the male and female judges).

TABLE III

Range (in %) of Raw Scores for Child and Adult Judges
Broken Down by Total Scores and ID of Non-native Scores

AGE	5	6	7	8	9	10	adults (oral)	adults (written)
Total Scores	20%	75%	50%	35%	30%	10%	25%	60%
ID of Non-native	50%	90%	50%	50%	20%	10%	20%	90%

Another way in which the incremental ability of the children can be measured is to look at the variance of the scores. TABLE III illustrates the range in raw scores for each age group, and, in general, the variance decreases with increasing age, illustrating again that the children are able to perform the discrimination task with progressively improving ability. Note that the range of raw scores for the adults in the discrimination of written passages is as wide as the range of raw scores for the younger children with the oral material. This suggests that random guessing strategies were adopted by the subjects when they could not perceive phonological or syntactic cues to identify the non-native informants.

TABLE IV

Number of Misidentifications per Non-native
Speaker Made by Each Age Group on Oral Corpus

			N=8	N=34	N=47	N=9	N=38	N=10	adults N=31	Total No. of MisIDs.
No.	Native Language	Sex								
#6	Arabic	M	3	26	20	3	5	0	0	57
#11	Swedish	F	3	13	17	2	2	0	5	42
#7	Chinese	F	3	12	12	3	2	1	0	33
#4	Romanian	F	4	13	13	0	0	0	1	31
#15	Irish English	M	2	6	8	3	5	0	1	25
#16	French	F	2	11	9	2	0	0	1	25
#14	Portuguese	F	1	7	6	2	0	0	0	16
#19	Lingala	M	0	7	5	1	0	0	0	13
#10	Spanish	M	0	5	4	0	0	0	0	9
#12	S. Afr. Ind. Eng.	M	0	4	3	1	0	0	0	8

Not all of the foreign speakers were correctly identified, of course, and it is interesting to look at an item analysis breakdown of which non-native speakers were misidentified by each age group. This data is supplied by TABLE IV. Although the number of misidentifications made by the adults is too small to draw significant conclusions from it is tantalizing to note that Speaker #6, who was misidentified most frequently by the children (57 times), was not misidentified by any of the adult judges. It was suggested to me that in the school situation, where the children were being tested, the pupils were used to hearing adult female voices, and were less successful in distinguishing adult male voices, like that of Speaker #6, because of infrequent exposure. This suggestion does not seem to be supported by the data, however, since the female informants were misidentified more frequently overall than the male speakers (147 times to 112). The frequent misidentification of Speaker #6 by the children, or, conversely, the failure to identify him by the adults, remains an intriguing question.

A linguistic explanation for the ranking of the misidentified speakers based on a historical or typological analysis of the native language of each individual informant does not appear to be justified. It can be pointed out, for example, that the speakers of the three non-Indo-European languages (Arabic, Chinese, and Lingala) were misidentified more often than the three highest ranked Indo-European languages (Swedish, Romanian, and French) - 103 times to 91. Perhaps most surprising of all, the two native speakers of English were much easier to identify as non-Americans than either the non-Indo-European speakers or the speakers of Swedish and Romance. It is difficult to account for the rankings of misidentified informants in terms of a linguistic description of the similarity of the informants' native languages to English. Although I have argued at the beginning of this paper that CA is a viable explanation for phonological errors, note that a strong version of the CA hypothesis must be quickly jettisoned when confronted with the data compiled in TABLE IV. It is indeed embarassing to account for the rank order of the native languages in terms of a CA between them and American English.

After having examined the data, it is time to give thought to some questions of a speculatory nature, questions which attempt to place this present study in a theoretical perspective and, at the same time, point to the many experiments which remain to be undertaken. The first question which arises from this material can be put quite simply, "Why do children improve in their ability to discriminate foreign accents?" It becomes apparent from looking at the background of the adult judges that degree of exposure to non-native speakers does not significantly affect the ability to isolate foreign sounding English. The few adult judges who misidentified some of the foreign informants did not differ from the other judges in their response to the questions on the scoring sheet requesting information about their exposure to foreigner talk. Although no data was gathered concerning the children's experience with non-native English, since they were all drawn from the same school in a relatively homogeneous middle-class suburban school district, it would be surprising to find exposure as an intervening variable. The increasing ability of the children with age can be explained in two ways. Either the children became more successful in defining the phonological limits of their native language through increased exposure, or they were learning sociocultural facts about their language (e.g. Americans don't say /kan/ for "can"; Spanish spakers say /θiŋk/ for "think"). It is also likely that both factors are at work, and that kids

improve in this discrimination task because they have acquired the ability to focus on their native language with greater perceptual accuracy, and, at the same time, they have learned some sociocultural facts which help them to isolate non-Americans.[4] Both the acquisition and the learning explanations should be explored more fully by further empirical studies.

TABLE V

Complete Recovery from Aphasic Symptoms in Children
(adapted from Lenneberg, pp. 147-149)

Patient's Age at Time of Insult (years)	1-3	4-5	6	7-8	9-11	12-18
Number of Patients within each Age Category	4	3	6	4	4	4
Number of Patients with Confirmed Permanent Aphasic Symptoms	0	0	0	0	2	3

Let us conclude by looking at the third claim put forth earlier about foreign accents, that their recognition is part of the competence of every native speaker. How is this recognition ability related to the production of foreign accents? By examining TABLE V, which lists the age for complete recovery from aphasia, note that none of the children younger than nine had permanent aphasic symptoms, but that permanent symptoms emerged at the ages of nine and older. It is interesting to see that the same approximate age when brain plasticity is lost is the age at which foreign accents emerge and is similar to the approximate age at which children reach the adult criterion of being able to identify foreign accents. It is therefore possible that the competence to recognize non-native speech is simultaneous in its development with the performance limitations which account for the production of non-native speech.

It is logically attractive to discover that recognition and production are chronologically linked, both to each other and to a certain stage of neurological development. More empirical work will have to be done, however, to discover if this logically appealing explanation is supported by experimental evidence. Very often, there is no close fit between logic and the real world.

1. Larry Selinker has raised the possibility that this claim might be too strong and that even excellent adult non-native users of English may have subtle syntactic or lexical errors which identify them as non-natives. He has suggested that the misuse of modals in some subtle English constructions may identify even the best adult second language speakers, irrespective of their foreign accents.

2. Roger Anderson has pointed out to me that the failure of the adult judges to identify as non-native the written corpora of the foreign subjects could very well be a result of the brevity of the written texts. Since the texts were short paragraphs with a few of them only a terse sentence or two, it is indeed likely that the adult judges lacked sufficient lexical and syntactic clues to adequately identify the non-natives. Longer written texts would most certainly improve the identification scores; at the same time, I would submit that the identification scores based on the written texts would never equal those based on the oral corpus - i.e., that superb non-native speakers like Christina Paulston cannot be identified from a written corpus of any length, while, at the same time, they are easily identified at the phonological level, even with a minimal oral corpus.

3. Steve Krashen has suggested to me that the above phenomenon fits comfortably into the monitor theory for adult second language learning. He argues that adult learners do not have time to employ the monitor in spoken forms of an L_2 - hence, the emergence of accents, acquisition errors; nonetheless, they do have time to monitor written errors, employing what they have learned about the L_2 to rectify syntactic or lexical mistakes. Therefore, good adult learners can emerge with almost errorless written texts in the L_2 because they have a chance to utilize what they have learned through the monitor. This opportunity is denied them, however, in speaking because they do not have time to monitor their L_2 output.

4. Again, note that the data is congruent with Krashen's hypothesis that people picking up a language both acquire and learn the language, although in this case, the monitor theory is extended to account for first language learning phenomena as well.

* The experiment reported on in this study resulted from the cooperation of many people. I would like to thank the staff of the Language Laboratory and the students and staff of the Department of General Linguistics at the University of Pittsburgh. Special gratitude is also expressed to the staff and students of Espe Elementary School of the North Allegheny School District for their enthusiastic participation.

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